



2011 PMOC Annual Meeting

FEDERAL TRANSIT ADMINISTRATION

Risk Review Process Basics

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Background

- As with many large, public projects, FTA experienced a significant amount of project cost overrun
- In this environment of overrun risk, planning a cost budget has been difficult
- The risk review process is intended to:
 - Inform the FTA about the project's risk
 - Provide the grantee with recommendations to strengthen the project


Uncertainty

“Uncertainty is the only certainty there is, and knowing how to live with insecurity is the only security.”

- John Allen Paulos

- The fundamental assumption is the grantee may decrease the level of uncertainty by studying the problem, exposing the risks, and taking actions to mitigate known risks

Certainty and Uncertainty

No Information	Partial Information	Complete Information	
Unknown unknowns	Known unknowns	Knowns	
 <p>Scope of project risk assessment</p>			
<u>Total Uncertainty</u>	<u>General Uncertainty</u>	<u>Specific Uncertainty</u>	<u>Total Certainty</u>

Risk Review vs. Risk Assessment

- Risk Review
 - FTA provides a review of the risk and contingency plan within a Grantee's project management plan
 - This review evaluates the 4 fundamental parts of risk management, i.e., Identification, Assessment, Response, Management
- Risk Assessment
 - 1 of the 4 parts that quantifies the impact of all risks
 - FTA treatment of risk assessment depends on the project's size

Risk Management Process

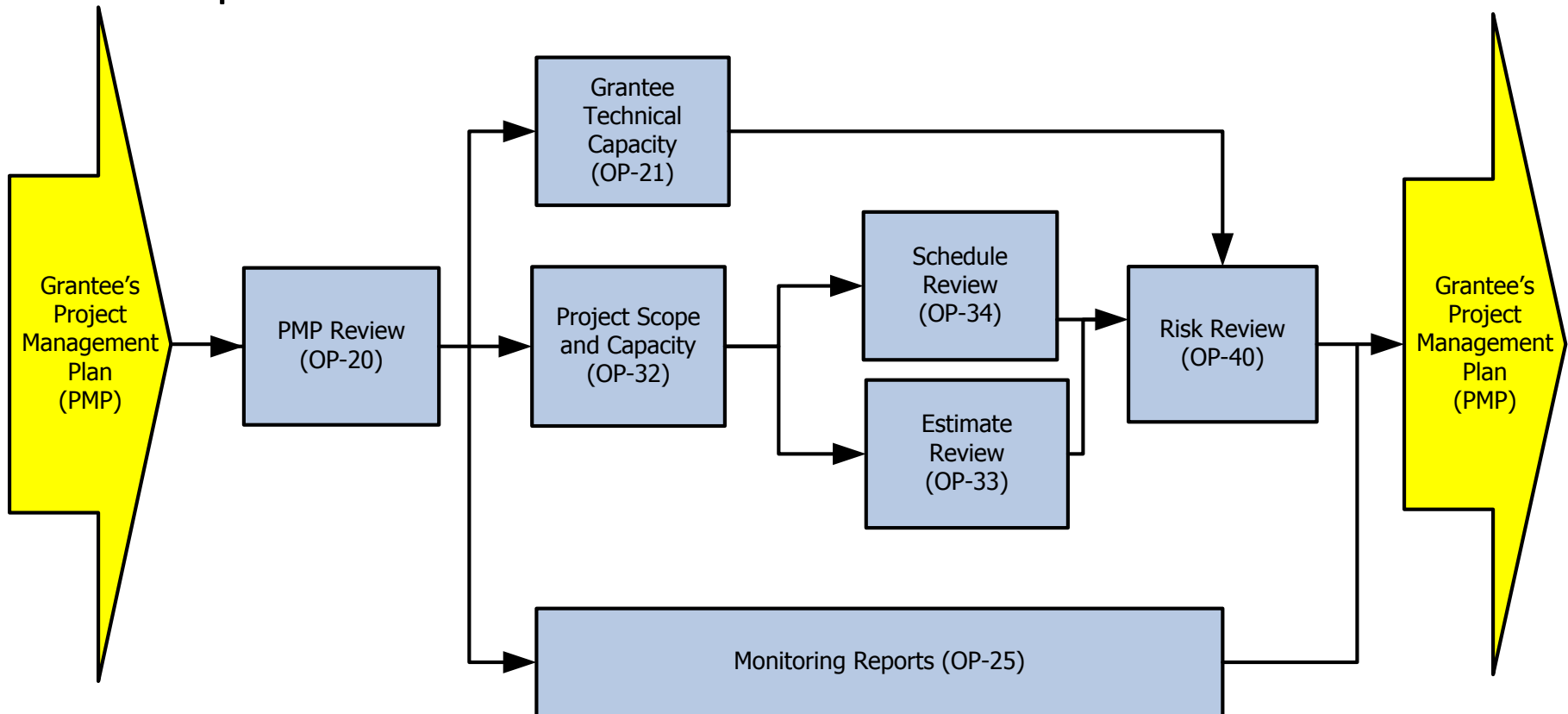
- **Identifying** risk situations for which outcomes are likely to vary in amounts that may significantly affect the project's goals
- **Assessing** the likelihood and magnitude of such variance
- **Responding** by developing plans for minimizing hazard and maximizing gain
- **Managing** the execution of those plans

Risk Review Benefits

- **Reviews an agency's technical capacity** and capability to perform the project
- **Identifies and develops action plans** for risky events
- **Creates informed assessment** of likely cost and schedule outcomes
- **Assures plans are in place** to protect the project

FTA Risk Review

Oversight Procedures (OPs) prescribe fundamentals of the risk review process

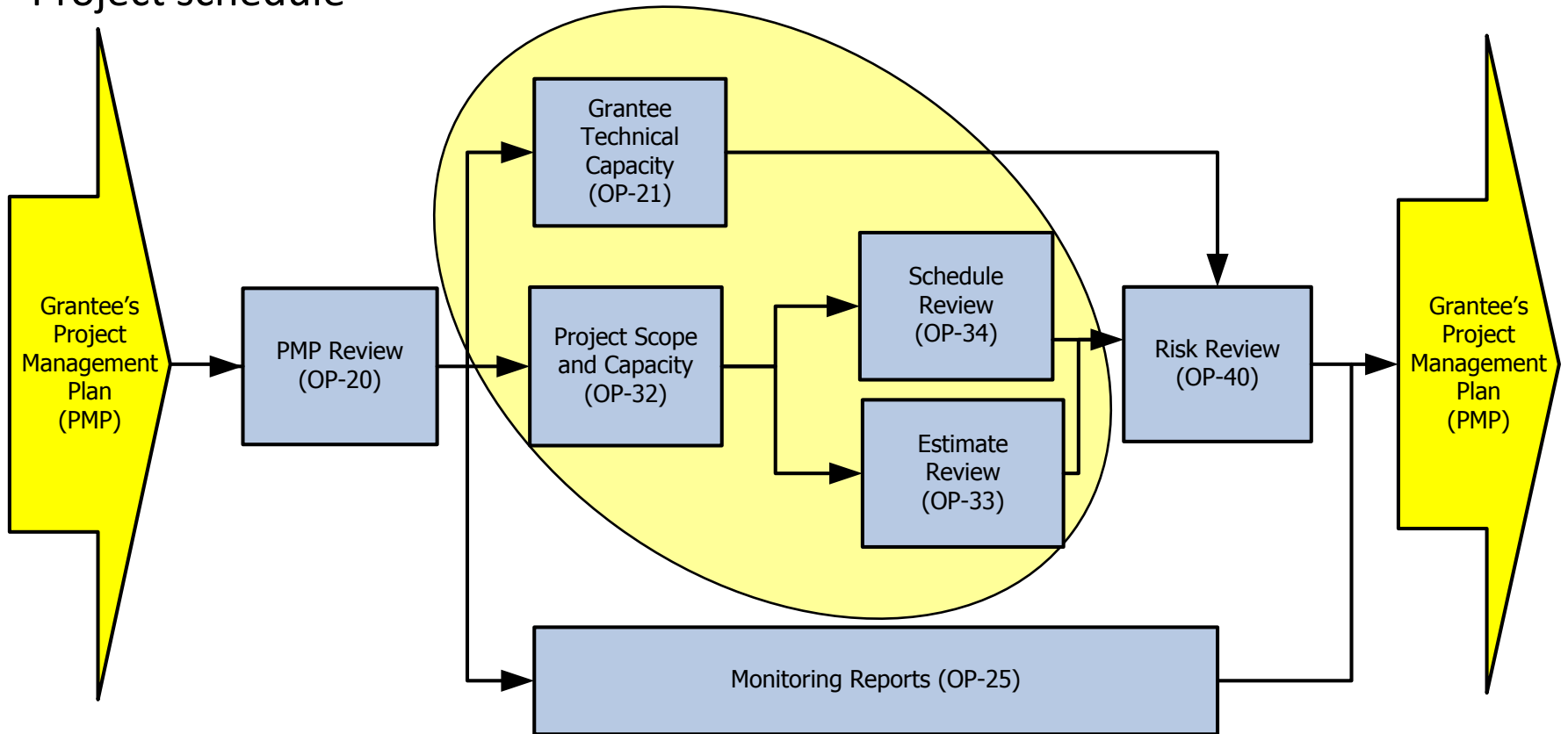


Presentation Outline

- Project Status Evaluation and Risk Assessment
 - Project Status Evaluation Procedures
 - Project Cost and Schedule Reviews
 - Risk Identification
 - Risk Categories
 - Risk Register
- Assessment Evaluation and Risk Management
 - Overview of Beta Model Development/ Interpretation
 - Overview of Cumulative Cost Risk Curve/ Schedule Risk Curve
 - Risk Mitigation
 - Risk and Contingency Management Plan (RCMP) Basics

Project Status Evaluation

- Technical capacity and capability
- Project capacity and scope
- Cost estimate
- Project schedule



The project status evaluation is a precursor to the detailed Risk Review

Risk Review Meetings

The Risk Review process involves 3 primary review meetings between the grantee, the PMOC, and FTA before each evaluation

- Supplemented by working groups designed to develop the details of the risk review
- It's important each meeting is attended by those most able to provide seasoned, professional input

Risk Review Meeting 1

- Introduce PMOC team and grantee team
- Grantee presents the project to PMOC team
 - Agency organization and project team plan for staffing
 - Description of work and reviews over the previous year
 - Review of the project by discipline
 - Review of schedule, cost estimate, and risk register, if available
- PMOC presents the risk process to grantee
- Tour of alignment, station, and support facility locations

Project Status Evaluation

- Fundamental project documents must be provided to the PMOC to complete the project status evaluation
 - Program documents
 - Project agreements
 - Design documentation
 - Cost estimates, with contingencies exposed
 - Schedule, with contingencies exposed
- If these elements are flawed or incomplete, risk assessment may be undermined before it even begins

Technical Capacity and Capability

- Evaluates grantee management, organization, and project definition data
- Requires:
 - Project program information
 - Interviews of grantee's organization
 - Grantee Project Management Plan (PMP)
- Assesses technical capacity and capability to implement the project in conformance with the Development Strategy
- Provides recommendations that should be addressed in the PMP

Project Capacity and Scope

- Evaluates the project's operating capacity, in terms of line capacity and ridership
 - Includes current and projected ridership
 - Considers phasing of facility
- Requires:
 - Project program, alignment, and ridership information
 - Capacity calculations (like TCRP-100 –ridership capacity worksheets and station stop worksheets, if used by Grantee, etc.)
- Identifies gaps (or requirements risks) in the forecasted balance between potential ridership and system capacity

Project Capacity and Scope

- Assesses the physical components of the project scope and how those components relate to their surroundings
 - Requirements for assessment depend on the project's phase
 - Compares against project description and initial goals
- Requires:
 - All program and design documents and investigative reports
 - Site evaluation visits
 - Scope checklist

Cost Estimate Review

- Review basis for Escalation Factor(s)
 - Standard Indices
 - Basis for Assumptions
- Review grantee's project cost estimate and general conditions in base year and escalated dollars
- Requires grantee's detailed cost estimate and back-up, Standard Cost Category (SCC) workbook, and project scope review results
- Provides a mathematical check of the estimate
- May include recommendations for adjustments to the grantee's budget estimate

Project Schedule Review

- Reviews grantee's project schedule
- Requires grantee's schedule, SCC workbook, and project scope review results
- Provides evaluation of schedule
- Continues discovery of items that are uncertain and constitute risks

Project Status Evaluation

- Upon completion of the Project Status Evaluation, FTA (through reports from the PMOC) has a thorough understanding of the project, grantee, cost and time required to complete the project, and uncertainties to be resolved
- Information revealed will be used by FTA for programmatic decisions and will form the basis for identification of risk events

Risk Identification

- Accumulate issues discovered through the various reviews and identify potential risk events
- Develop a Risk Register
 - listing of risk events
- Categorize by SCC code
- Categorize by risk type:
 - Requirements
 - Design
 - Market
 - Construction

Risk Identification

- Risk identification is a collaborative process
- Purpose is to objectively discover potential threats to the project's goals
- Starting points for risk event identification:
 1. PMOC's listing of issues discovered through the project status reviews
 2. Grantee's own risk analysis (if undertaken)

Risk Review Meeting 2

- PMOC summary reviews of technical capacity and capability, scope, cost, and schedule
- Discuss risks identified by PMOC and record additional risks discovered during the workshop
- Enter into discussions with grantee's project team to resolve open questions
- Discuss actions required to facilitate the next stage of quantitative risk assessment
- Inform grantee of next steps

Key Individuals

- Project owner
- Staff of project owner
 - Management staff, preferably those who participated in any earlier risk reviews
 - Appropriate technical staff (e.g., operations staff)
- Senior members of the project team
- Including cost, schedule, design experts, etc.
Participating or affected agencies
- If risk mitigation measures have been allocated to contractors, their management and technical staff should be involved
- Risk facilitator

Risk Factoring

- **Probability (P)** – chance of occurrence
- **Magnitude (M)** – value
- These 2 factors determine the **expected value (E)** of a risk event

$$E = P * M$$

Risk Factoring

- It is helpful to provide guidance regarding what constitutes each category of probability or magnitude assessment
- One possible risk factoring:

Assessment	Low (1)	Medium (2)	High (3)
Probability	< 10%	10% – 50%	> 50%
Cost (\$)	< \$1.0 million	\$1.0 – \$5.0 million	> \$10.0 million
Time (months) – potential delay	< 1 month	1 – 12 months	> 12 months

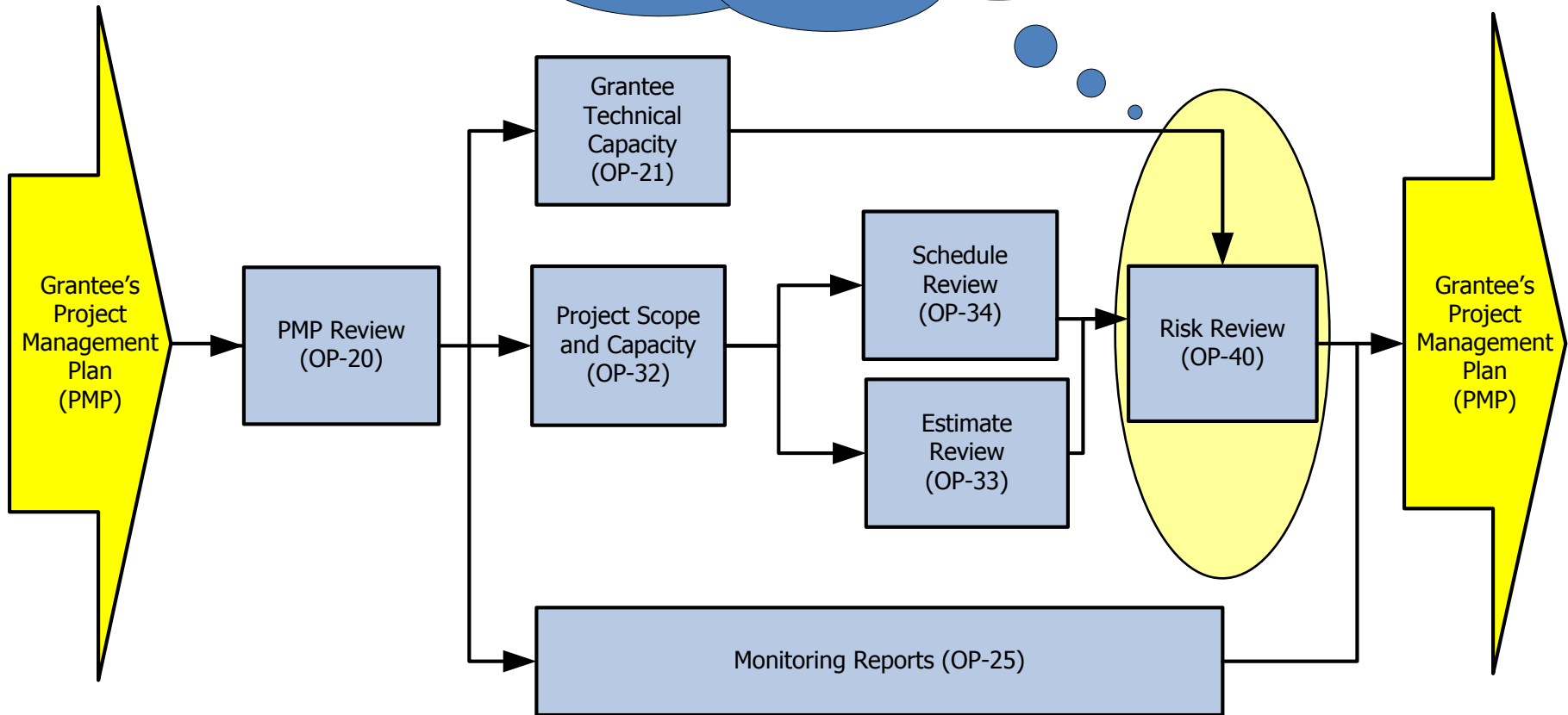
Risk Register

- An initial evaluation of the expected value of each risk is made

Risk Register							
SCC Code	<u>Identification</u>		<u>Assessment</u>				
	Risk event description	Risk Type	Probability (A)	Cost Magnitude (B)	Schedule Magnitude (C)	Expected Value	Expected Value
			3 = high 2 = medium 1 = low	3 = high 2 = medium 1 = low	3 = high 2 = medium 1 = low	Cost Score	Schedule Score
1							
2							
3							
4							

Risk Review

Risk assessment by PMOC after risk identification workshop with Grantee



FTA Standard Cost Categories (SCC Codes)

10	Guideway and Track Elements
20	Stations, Stops, Terminals, Intermodals
30	Support Facilities: Yards, Shops, Administration Buildings
40	Sitework and Special Conditions
50	Systems
60	Right-of-Way, Land, Existing Improvements
70	Vehicles
80	Professional Services
90	Unallocated Contingency
100	Finance Charges

Risk Assessment Steps

1. Strip the estimate and schedules of all contingencies
2. Summarize the costs and activities
3. Apply ranges of cost and durations to the summaries
4. Calculate the range of cost and schedule for the project

Cost and Schedule Risk Assessment

1. The schedule and cost estimate are “scrubbed” of contingencies and adjusted by the PMOC
 - Identify and remove hidden and exposed contingencies
 - Remaining schedule and cost estimate are used to forecast risk on the project

After the first step, the cost and schedule assessment processes differ

Cost Risk Assessment

- Summarize the grantee's scrubbed and adjusted estimate into the SCC

SCC	Category	10%
SCC 10	Guideway	
10.01	Guideway: At-grade exclusive right-of-way	42,501
10.04	Guideway: Aerial Structure	51,900
10.11	Track: Ballasted	45,176
SCC 20	Stations, Stops, Terminals, Intermodals	
20.01	At-grade station, stop, shelter, mall, terminal, platform	45,122
20.02	Aerial station, stop, shelter, mall, terminal, platform	46,551
20.06	Automobile parking multi-story structure	215,380
20.07	Elevators, escalators	9,248

Cost Risk Assessment

3. A “range multiplier” (Beta) is applied to the “scrubbed” and adjusted estimate, on a category-by-category basis, to yield the range from highly optimistic (10%) to highly pessimistic (90%)
 - The range multiplier varies depending on the phase of project development
 - FTA provides recommended values for the Beta factor

Cost Risk Assessment

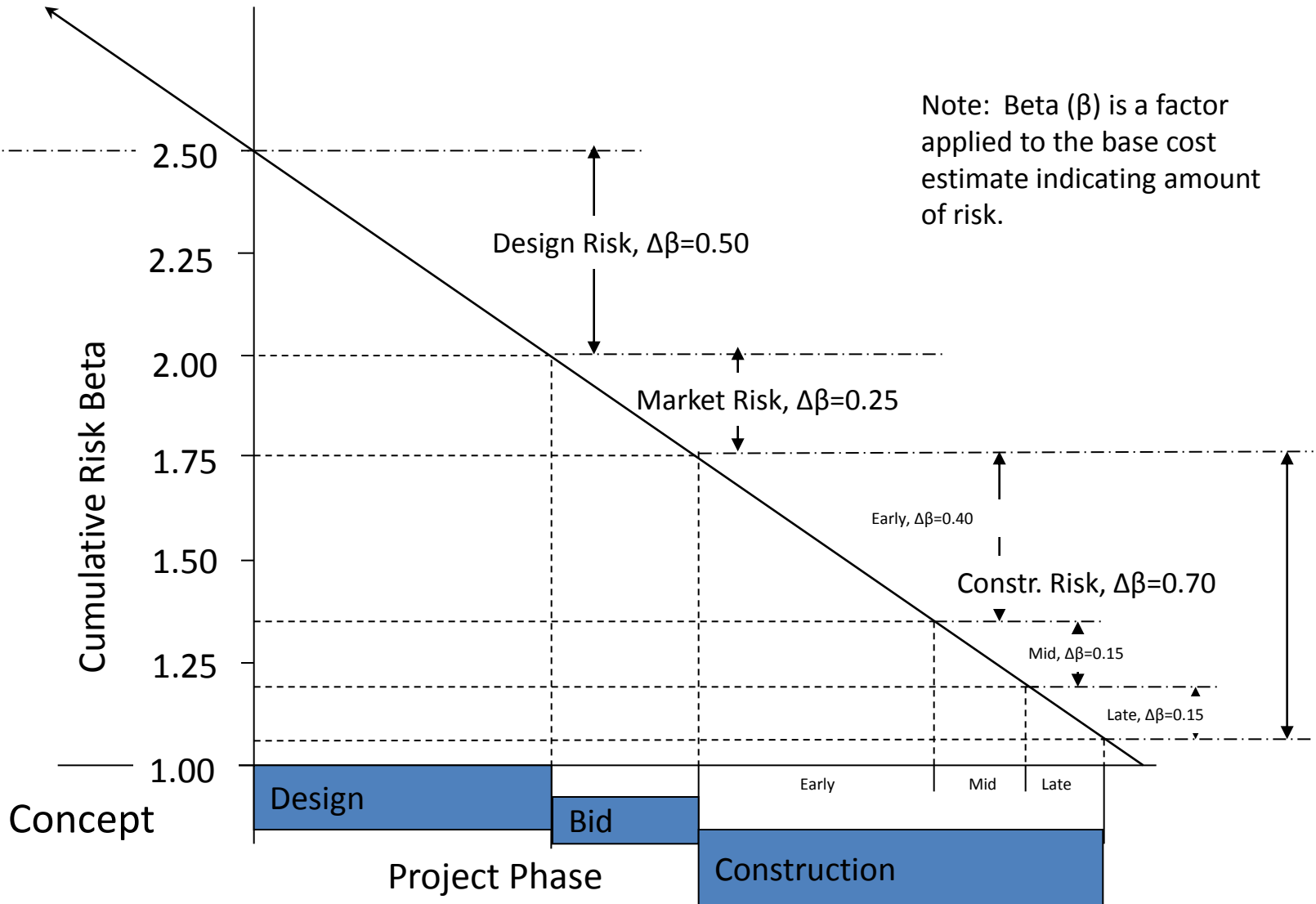
How is the Beta chosen?

- Depends on what phase the elements of the project are in: the earlier in the process, the more unknowns and the higher the risk
- 4 stages of project completion are considered important; completion of each phase successively reduces risk

<u>Stage of Project Completion</u>	<u>Risk</u>	<u>Example</u>
Requirements definition	Requirements risk	Unknown stakeholder requirements for station
Project design	Design risk	Vertical alignment issues
Construction contracts procurement	Market risk	Significant spike in cost of steel
Project construction	Construction risk	Unforeseen conditions, project interference

Cost Risk Assessment

Requirements Risk,
 $\Delta\beta=?$



Cost Risk Assessment

Sample Beta assessment

SCC	Category	10%	Requirements Beta	Design Beta	Marketing Beta	Construction Beta	Post Construction Beta	Total Beta
SCC 10	Guideway							
10.01	Guideway: At-grade exclusive right-of-way	42,501	0.00	0.50	0.25	0.70	0.05	2.50
10.04	Guideway: Aerial Structure	51,900	0.00	0.50	0.25	0.70	0.05	2.50
10.11	Track: Ballasted	45,176	0.00	0.50	0.25	0.70	0.05	2.50
SCC 20	Stations, Stops, Terminals, Intermodals							
20.01	At-grade station, stop, shelter, mall, terminal, platform	45,122	0.00	0.50	0.25	0.70	0.05	2.50
20.02	Aerial Station, stop, shelter, mall, terminal, platform	46,551	0.00	0.50	0.25	0.70	0.05	2.50
20.06	Automobile parking multi-story structure	215,380	0.00	0.50	0.25	0.70	0.05	2.50
20.07	Elevators, escalators	9,248	0.00	0.50	0.25	0.70	0.05	2.50

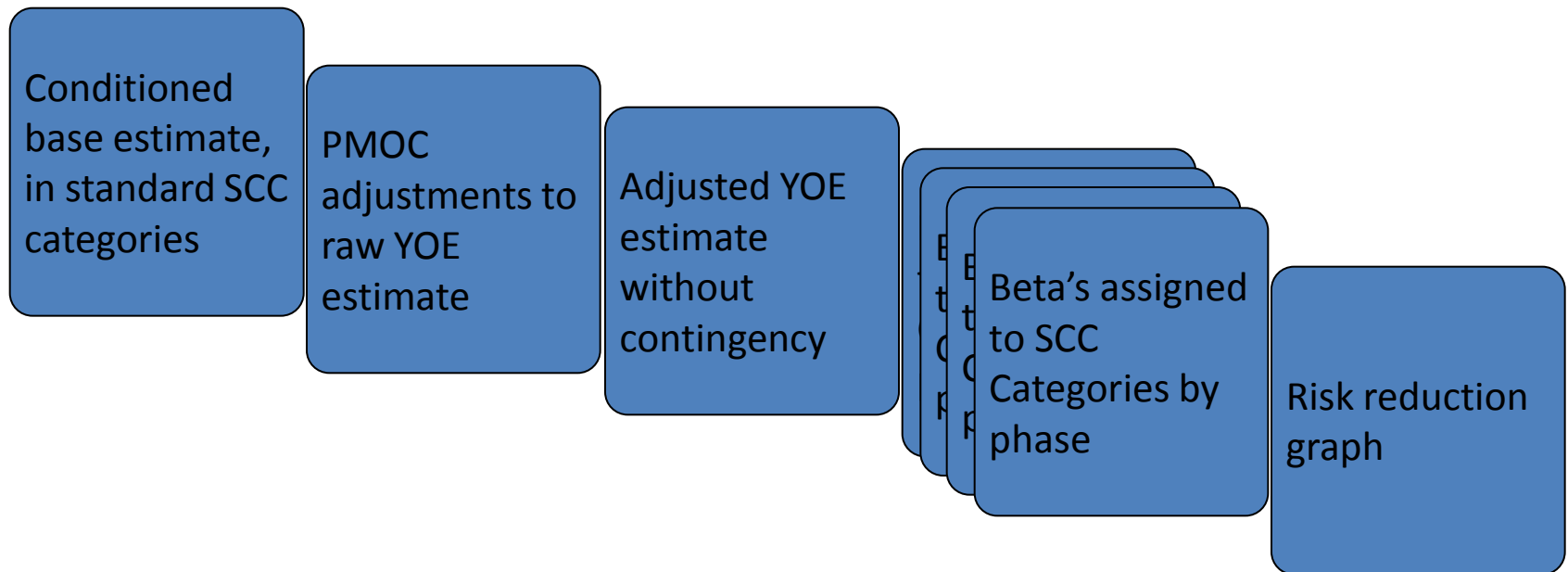
Note: Total Beta includes starting base of 1.0

Cost Risk Assessment

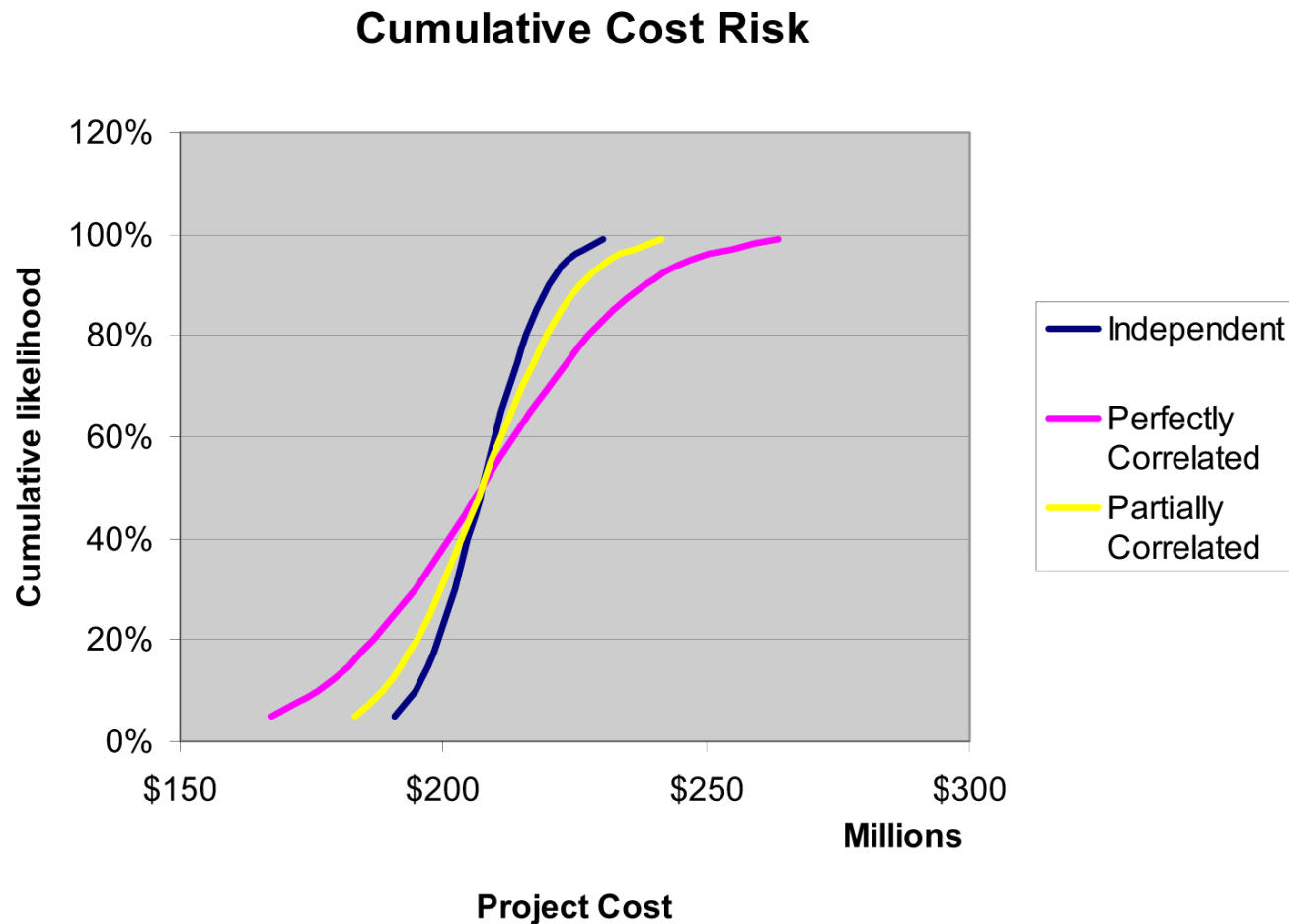
4. Categories of the project are then aggregated probabilistically to yield likely project outcomes
 - PMOC will use the Cost Risk Assessment Workbook to simplify the process of project risk assessment range modeling

Cost Risk Assessment

- PMOC uses the OP-40 Cost Risk Assessment Workbook
- Consists of several parts:

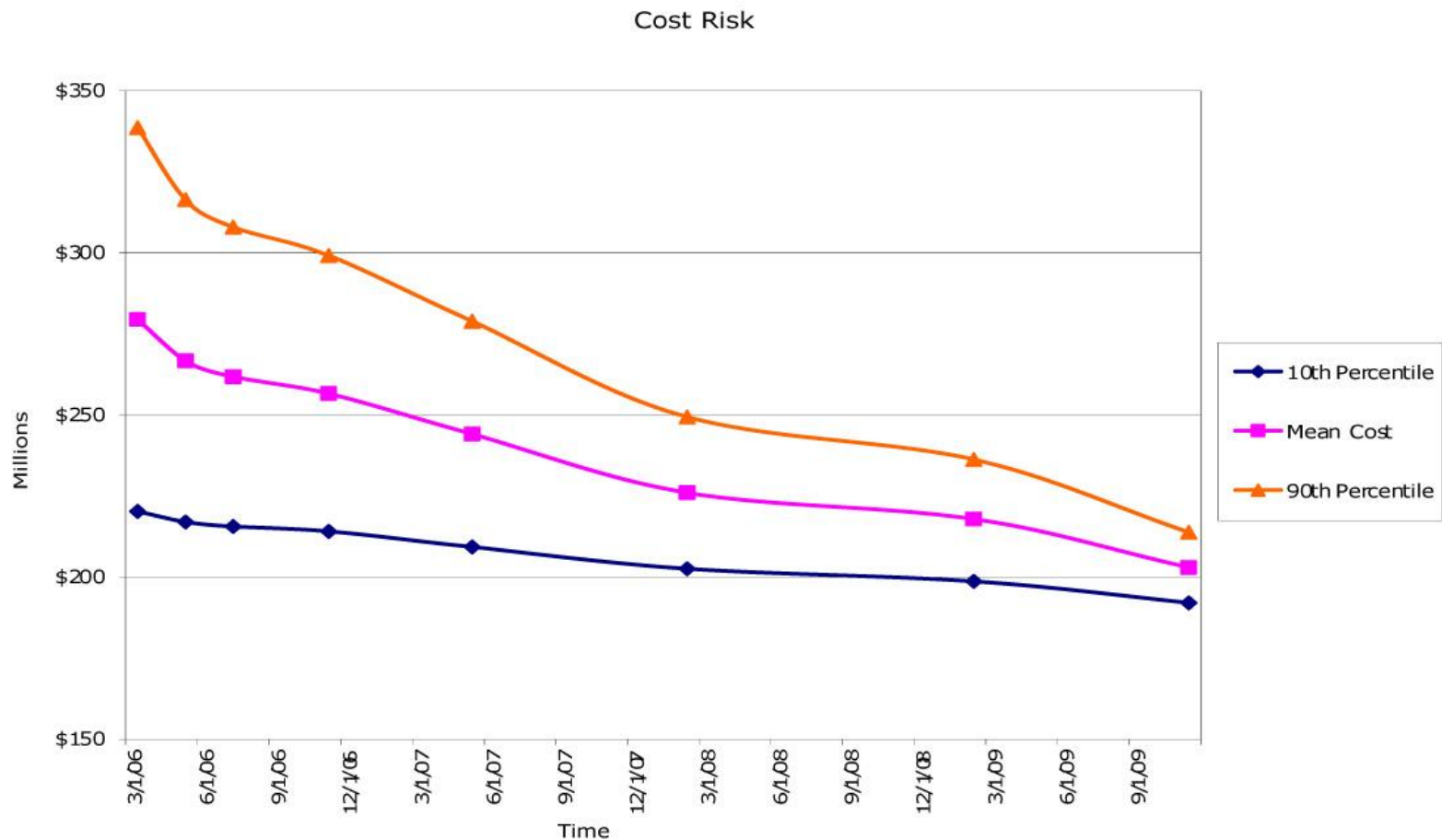


Cost Risk Assessment



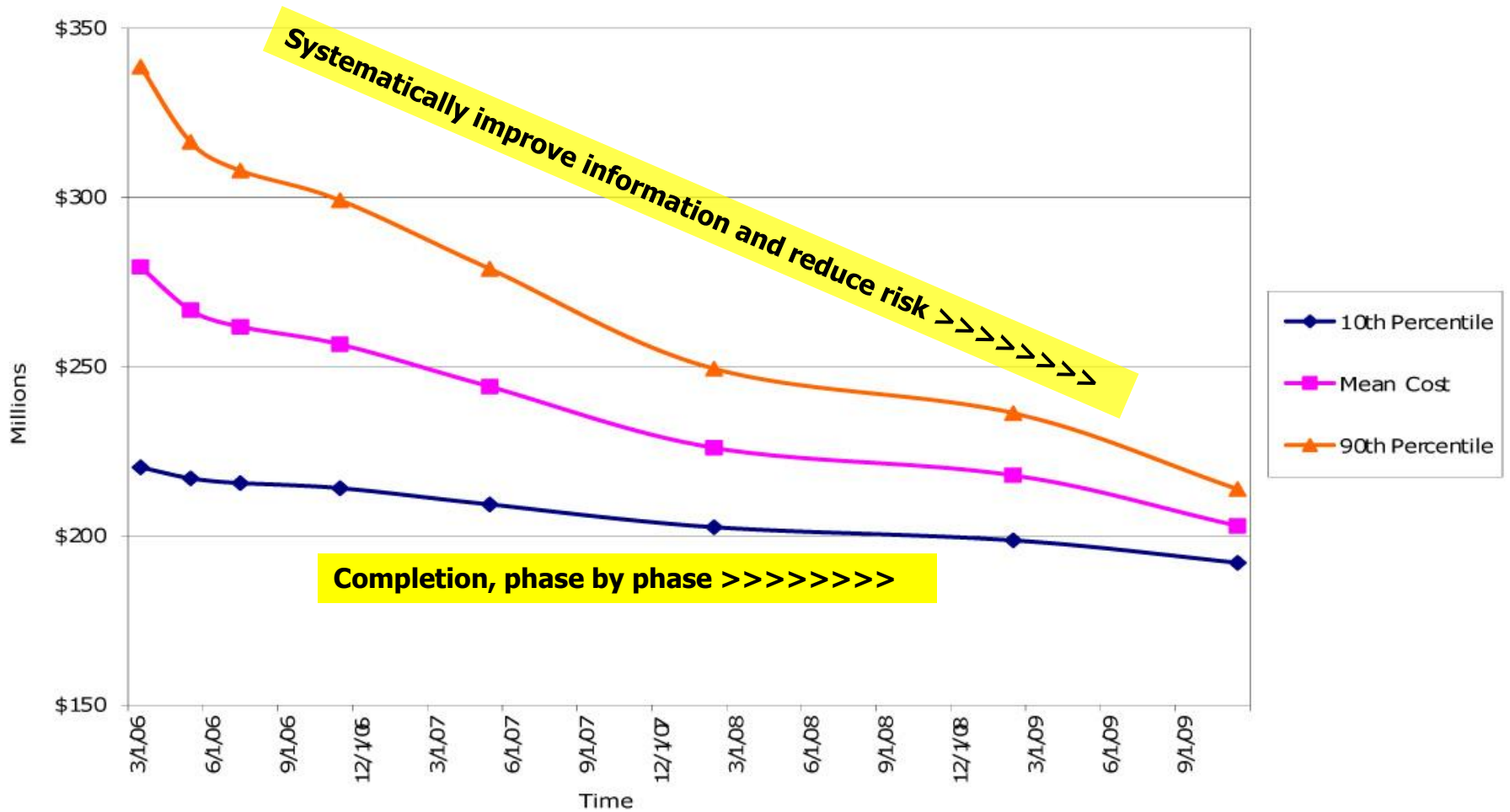
Cost Risk Assessment

Project is “forecasted” out to each stage of development to identify potential risk reduction; the results are plotted across the project life-cycle, as if all mitigation is successful



Cost Risks

Cost Risk

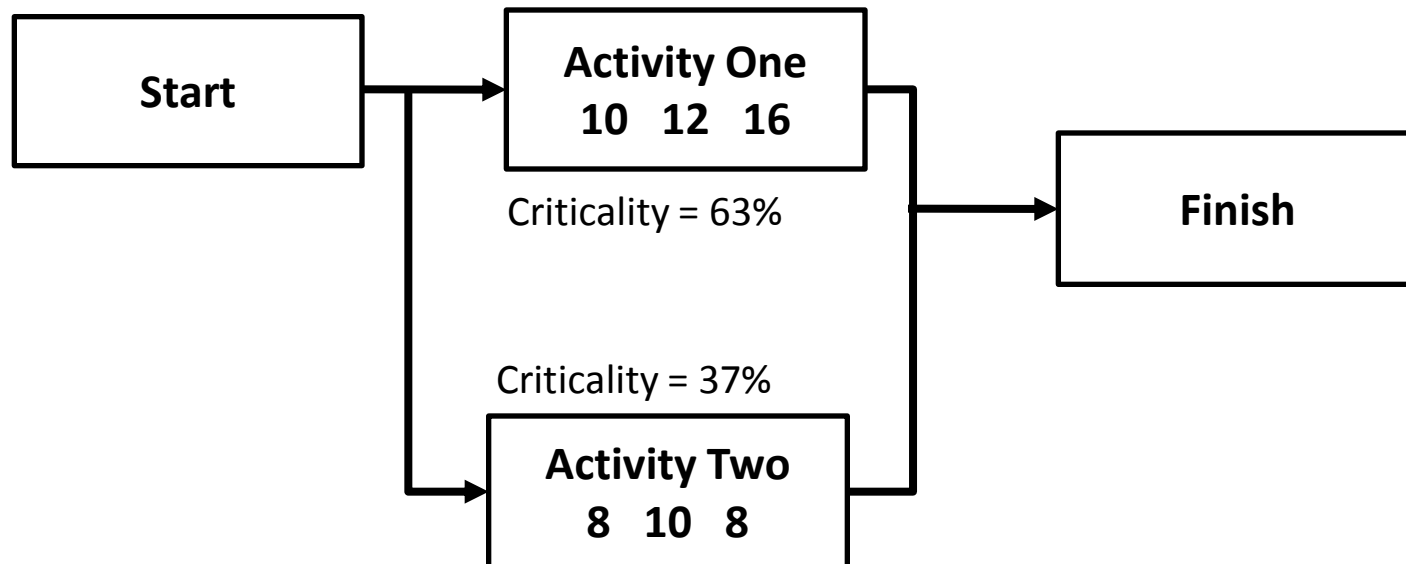


Project
Conception

Project
Completion

Schedule Risk Assessment

2. A summary schedule is developed with a reasonable number of activities



Schedule Risk Assessment

- The duration range is established based on the risk register and applied to the summarized schedule

		Orig Dur	Rem Dur	% Comp	Early Start	Early Finish	OPTIMISTIC	MOST LIKELY	PESSIMISTIC
Pico/Aliso Station									
Segment 'at grade' works									
9815	Segment 2 – Utility diversions and duct banks	225	71	68	30NOV05A	10DEC07	65	75	93
9835	Segment 2 – 1 st Street bridge track bed/track	129	129	0	08JAN07A	28FEB08	100	129	149
9819	Segment 2a/b – Complete systems installation	221	221	0	11DEC07	14OCT08	199	221	243
9820	Segment 2 – Sequencing/resource constraints	20	20	0	5OCT08	11NOV08	5	20	40
Station									
980	Pico/Aliso – Final design and MTA approvals	118	0	100	30NOV05A	11MAY06A			
981	Traffic plan approvals and street closures	61	0	100	15MAY06A	31JUL06A			
9810	Peco/Aliso station demo and structure	95	47	51	01FEB07A	06NOV07	40	52	69
9830	Peco/Aloso MEP and Str restore and punch list	190	190	0	07NOV07*	29JUL08	180	200	212

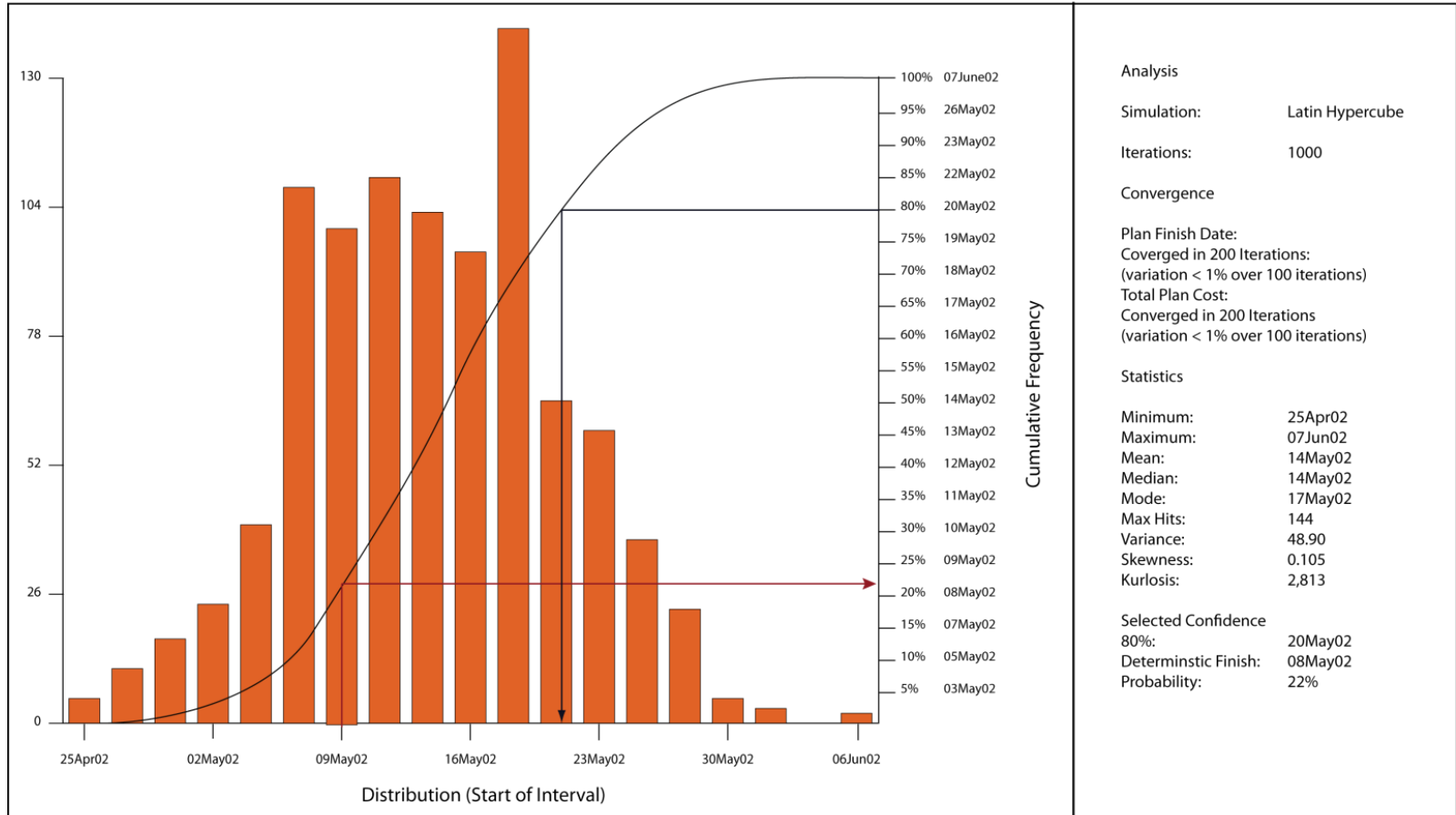
Schedule Risk Assessment

4. Range-loaded activities are then simulated (using Monte Carlo methods) to yield likely project outcomes
 - The results are reviewed and rerun as necessary for schedule integrity
 - The results may affect the cost analysis

FTA Schedule Risk Assessment

The results indicate the likelihood of meeting the target completion date

Risk Project
Entire Plan: Finish Date



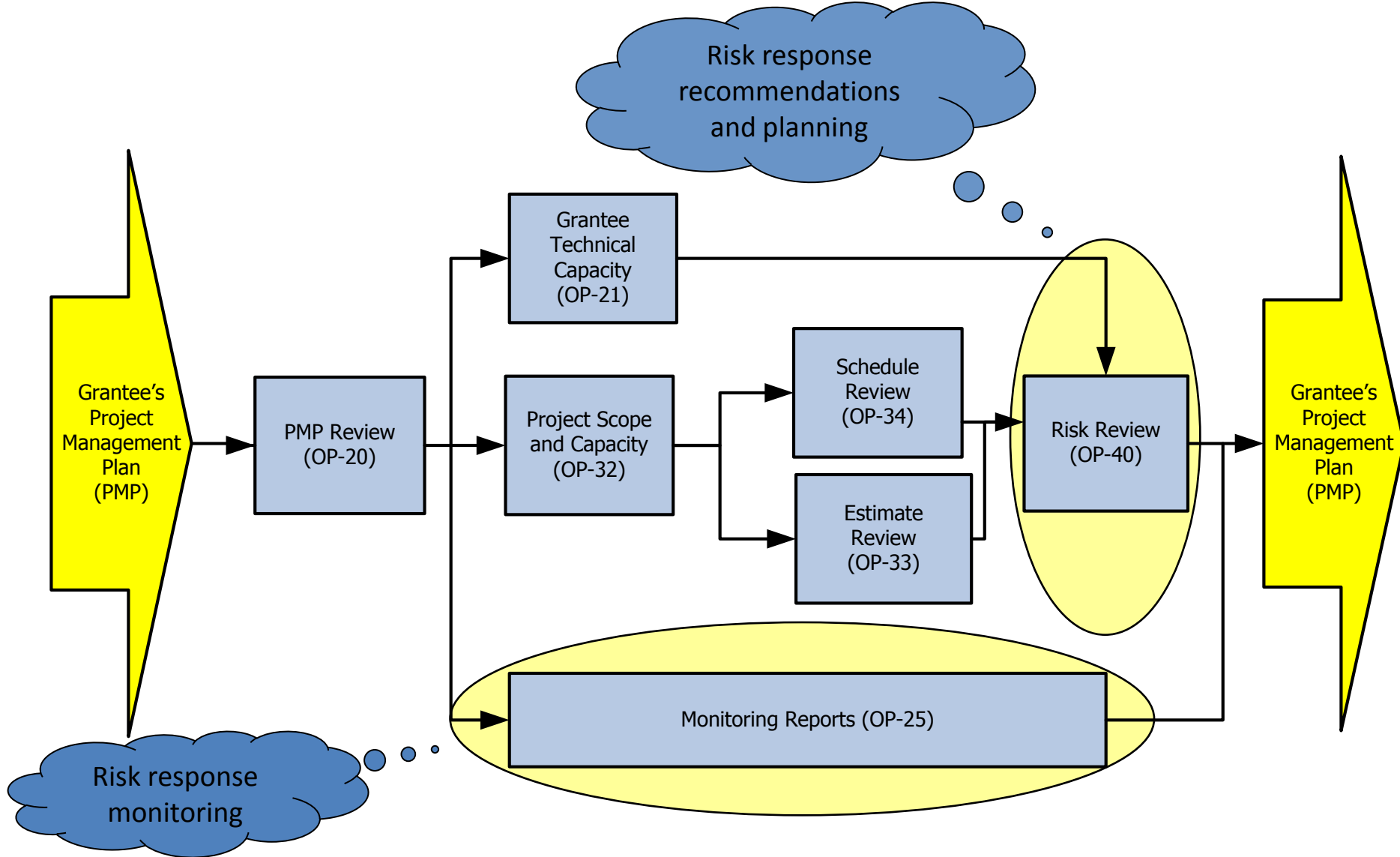
Pertmaster Limited

*See back of module for larger graphic

Risk Review Meeting 3

- Describe process used to develop quantitative risk assessment
- Summarize key findings of the assessment
- Provide recommendations regarding risk
- Review which risks strongly influence overall project risk
- Review specific recommended mitigation measures and solicit completion dates
- Discuss action items and next steps

Risk Response



4 Risk Responses (Risk Aversion Order)

1. Avoidance

- Pursue a different project or project element
- Alternatives Analysis is used here

2. Transfer

- By contract or agreement with the performing parties
- Major concepts to be considered:
 - Efficient allocation of risk
 - Equitable allocation of risk

4 Risk Responses (Risk Aversion Order)

3. Reduce

- Modify either the **probability (P)** or **magnitude (M)**, or both, reducing the **expected value (E)** of the risk

$$E = P * M$$

- Modify the design or PMP
- Protect against theft or damage
- Influence the project's environment

4 Risk Responses (Risk Aversion Order)

4. Retain/absorb

- Recognize a risk event, but take no action
 - If it appears to be of minimal consequence
- Retain it and protect against it
 - Where risks are unavoidable
 - Establish contingencies that can absorb realized risks
 - Develop a “Plan B” in case risks become realized

Risk Response Recommendations

Two types of information are used:

1. Qualitative information is used to develop mitigation action plans for the grantee to undertake, through the use of “**Primary Mitigation**”
2. Quantitative information is used to establish **Risk Protection** against the inherent project risk through the use of “**Contingencies**” and “**Secondary Mitigation**”

Primary Risk Mitigation

- Executed by the grantee through completing efforts described in the grantee's most current Risk Contingency Management Plan in the PMP
- Grantee's plans should be consistent with the risk review and mitigation recommendations
- Work is monitored on a continual basis during the PMOC's monthly monitoring and oversight
- Failure to adequately complete work translates to greater uncertainty as the project moves forward

Risk Protection

Risk protection is approached from 2 directions:

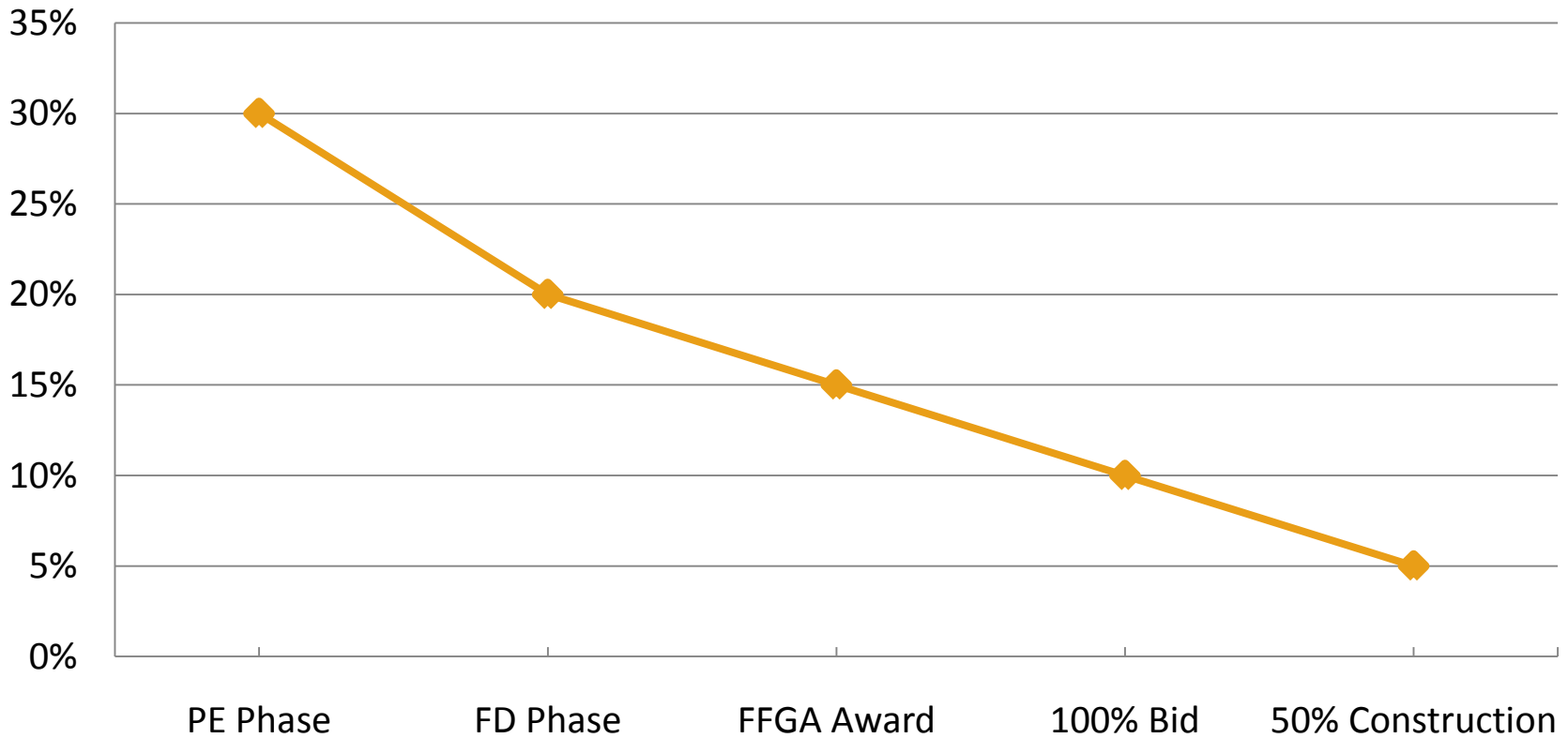
- **Contingency** – budgeted amounts to overcome “normal” overruns
- **Secondary Mitigation** – development of plans to recover cost or schedule overruns using redesign techniques where contingency is insufficient

Cost Contingency

- FTA risk review provides quantitative modeling to assess the sufficiency of the grantee's budget at various project phases
- Specific target values are identified at primary phases:
 - Entry to Preliminary Engineering
 - Entry to Final Design
 - FFGA
 - Construction
- The target values vary, depending on the project phase current at the time of calculation

Cost Contingency Targets

Cost Contingency Targets



Cost Contingency

- An additional analysis of specific, potential project risks is conducted to determine how contingency must be maintained and at what amounts throughout the project completion
- This is called the “backward pass” method
- This analysis identifies points during the construction period at which certain minimums of contingency should be maintained to protect the project;

Schedule Contingency

- FTA also established criteria for suggested minimum schedule contingency levels
- The targeted amount of schedule contingency, for the project as a whole, is 20% of the “stripped” duration from Final Design through Construction completion

Schedule Contingency

- In an analysis similar to that for cost contingency, a separate, detailed analysis of minimum schedule contingency levels occur
- This analysis identifies points during the project phases at which certain minimums of schedule contingency must be maintained

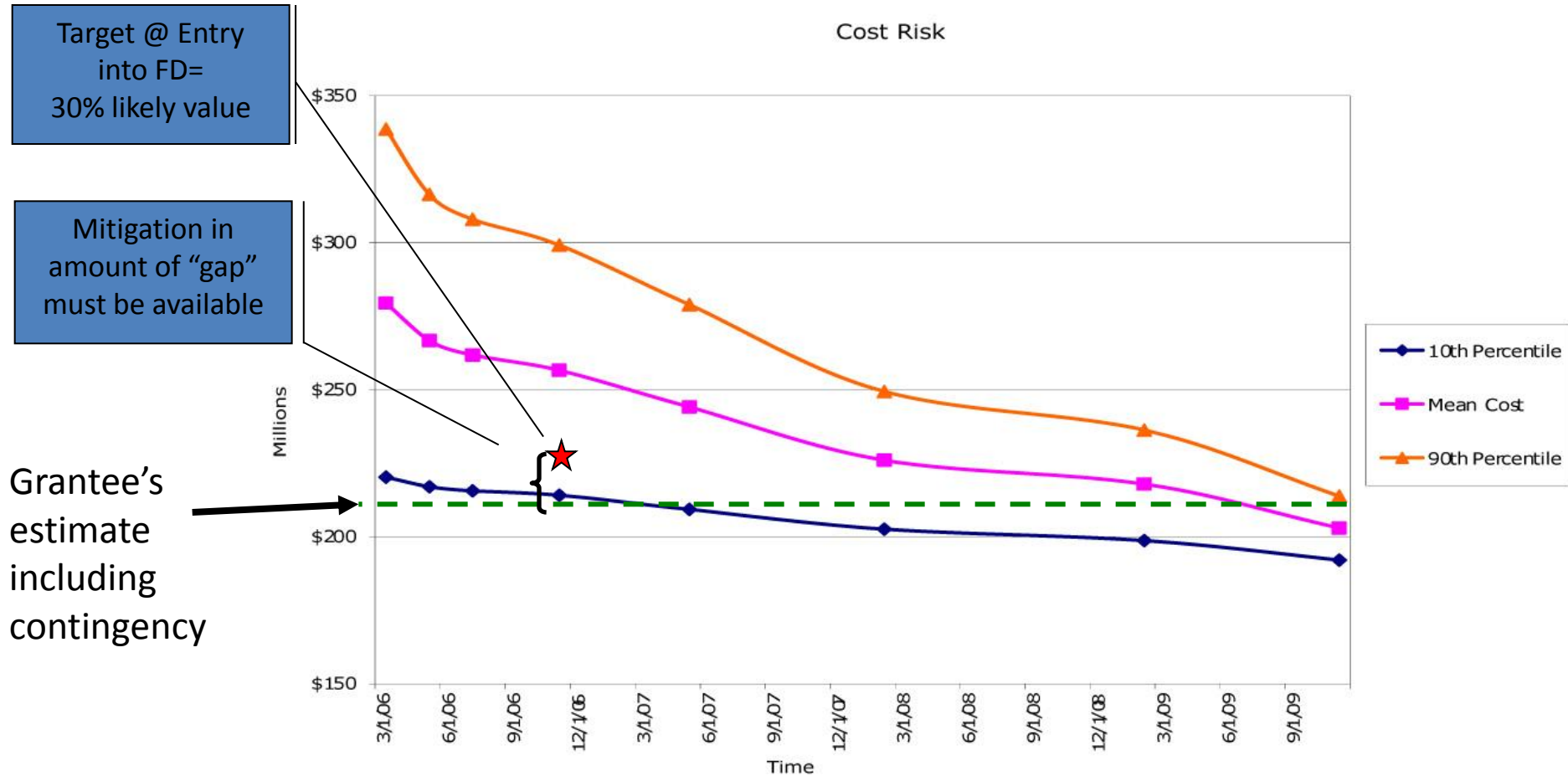
Cost and Schedule Contingency

- Contingency needs are analyzed on an individual project basis by looking at specific risks
- Contingency is not released until these risks are no longer of concern
- “Project Milestones” indicate the times and amounts at which the contingency minimum may be reduced
- Final recommendation is developed by PMOC in consideration of 3 forecast methods

Secondary Mitigation

- To determine the amount of capacity a grantee should maintain, the FTA establishes targets for specific phases of the project
- Secondary Mitigation does not reduce the functionality of the initial project
- At a given stage of a project, the grantee's estimate (including contingency) is compared against a target point within the potential range of cost risk
 - The difference is called the “gap”

Secondary Mitigation



Risk Management Planning

General process for risk management begins with a written Risk and Contingency Management Plan (RCMP):

- Documentation of the various analyses
- Listing of major project risks, their description and the nature of their consequences
 - How they are to be handled (by whom, when)
- “Watch List”
 - A list of secondary and/or residual minor risks that need to be kept an eye on
- Timing for re-examination of the Risk Management portion of the PMP

RCMP Requirements

- Section of the Grantee's Project Management Plan (PMP)
- Fully updated and active PMP
- Highlight specific areas of management focus as identified through the risk review process
- Means for monitoring Grantee's progress
 - Actions to strengthen technical capacity and capability, project performance, cost and schedule analyses, mitigations of identified project risks, and others.
- Information contained within the RCMP should complement and not be in conflict with information contained elsewhere within the PMP or in other FTA guidance documents

RCMP Overview

Topics:

- Primary Mitigation, organized by significant project activities, such as:
 - Technical Capacity
 - Project Scoping and Design;
 - Delivery Methods and Contracting;
 - Construction Process;
 - Project Tracking, including:
 - Cost Estimating, Financing and Financial Management;
and
 - Project Schedule Management.

RCMP Overview

- **Insurance:**
 - Professional services, construction phase, wrap-up, or other specialized insurances purchased for reduction of risk exposure
- **Contingency Management:**
 - Cost Contingency Management Plan; and
 - Schedule Contingency Management Plan
- **Secondary Mitigation:**
 - Establishment of Secondary Mitigation actions and cost targets which may trigger the implementation of Secondary Mitigation
- **Risk Management:**
 - Risks management and mitigation monitoring, change identification, and management controls

Risk Management Planning

- Risk Management Plan is a combination of elements within the grantee's PMP and its sub-parts
- Primary Mitigation occurs through professional planning, design, and execution
- Risk Protection involves planning for the “what-ifs” (e.g., What if poor soils unexpectedly arise?, What if the market tightens?)
- Written plans to handle project overages result in a well-managed response to any crisis and should be documented within the PMP
- Plans are updated as the project progresses

Risk Management Process

- The process of:
 - Identifying risk situations, for which outcomes are likely to vary in amounts that may significantly affect the project's goals
 - Assessing the likelihood and magnitude of such variance
 - Establishing plans for minimizing hazard and maximizing gain
 - Managing the execution of those plans
- A rational means for working in an uncertain world

Risk workshops and meetings

Meeting	Purpose	When	Attendance	Note
Introduction	Introduce team, get to know the project, discuss risk process	Before formal risk workshops	Project management, technical experts, lead designers	May be reduced during risk refreshes
Risk workshop #1	Establish current risk register, evaluate risks, identify potential mitigations	After scope, cost, schedule etc. reviews. PMOC list of risks required.	Project management, technical experts, lead designers	If Grantee has a risk process, focus on suggested amendments to Grantee's risk register
Risk workshop #2	Discuss findings from PMOC risk modeling; next steps	After PMOC risk modeling and after FTA concurrence with recommendations; discuss key mitigations	Project management	
Risk workshop #3 (optional)	Discuss mitigations if not discussed earlier	After workshop #2, before finalizing OP40 report	Project management, technical experts, lead designers	May not be required if covered in workshops #1&2